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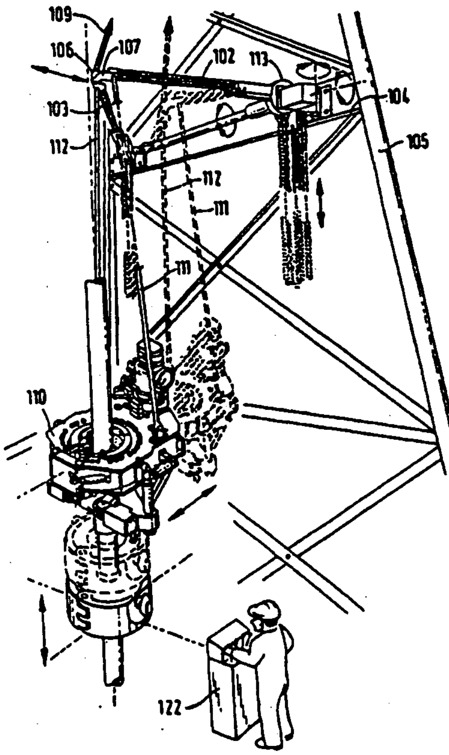
(54) **Title:** POSITIONING APPARATUS FOR A POWER TONG

(57) **Abstract**

A positioning apparatus for moving a power tong (110) between an operative and an inoperative position in a drilling tower (105) comprises a first arm (102) and a second arm (103). One end of the first arm (102) is pivotally connected to one end of the second arm (103) at pivot (106) whilst the other end of both the first arm (102) and the second arm (103) are pivotally mounted on a beam (104) attached to the drilling tower (105). Both arms (102, 103) can be extended and retracted in unison to move the power tong (110) towards and away from its operation position circumjacent a pipe string.



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Positioning apparatus for a power tong

This invention relates to a positioning apparatus for moving a power tong between an operative and an inoperative position in a drilling rig.

Power tongs are used to connect and disconnect threaded tubulars used in the construction of oil and gas wells.

Typically, power tongs are suspended by a cable attached to a support member high in the drilling tower. When it is desired to connect or disconnect two threaded tubulars the power tong is manually swung into position and closed circumjacent the tubulars. When the operation is completed the power tong is released and allowed to swing back into an inoperative position.

Manoeuvring the power tong requires considerable strength and is very difficult when the power tong is designed for handling large diameter tubulars and is thus very heavy.

In EP-A-0 593 803 (which was not published until after the priority date of this application) the Applicants describe a positioning apparatus for assisting in the positioning of power tongs. Whilst this positioning apparatus allows a power tong to be easily manipulated it is still desirable to have a rig hand in the immediate vicinity of the tubulars to ensure that the power tong is correctly placed on the tubulars.

The present invention, at least in its preferred embodiments, aims to obviate the need for a rig hand in the immediate vicinity of the power tong.

According to the present invention there is provided a positioning apparatus for moving a power tong between an operative and an inoperative position in a drilling tower, which positioning apparatus comprises a first arm and a second arm, one end of said first arm being pivotally mounted to one end of said second arm and the other end of both said first arm and said second arm being pivotally mountable on said drilling tower with said first arm and said second arm converging towards one another, and means for extending and retracting said first arm and said second arm.

Preferably, the positioning apparatus includes a beam and the other end of both said first arm and said second arm are pivotally mounted on said beam.

Advantageously, the positioning apparatus includes means for extending and retracting said first arm and said second arm in unison.

In one embodiment, at least one of said first and second arms is formed by the interconnection of two chains the links of one of which chains are provided with blocking members which can co-operate with the links of the other chain to form said arm.

In another embodiment at least one of said first and second arms is formed by a piston and cylinder which is preferably double acting.

In a further embodiment, at least one of said first and second arms comprises a rack which can be moved by rotation of a pinion or a worm drive engaged therewith.

Preferably, the positioning apparatus includes a cable for supporting said first arm and said second arm in a generally horizontal plane.

The present invention also provides a drilling tower provided with a positioning apparatus in accordance with the present invention.

Preferably, said first arm and said second arm are supported in a generally horizontal plane.

Advantageously, said one ends of said first arm and said second arm are pivotally mounted together about a generally vertical axis and said other ends of said first arm and said second arm are pivotally mounted about a generally vertical axis.

Preferably, said other ends of said first arm and said second arm are pivotally mounted for movement about a generally horizontal axis.

Advantageously, said drilling tower includes a power tong supported by said positioning apparatus.

Preferably, said power tong is supported via two support members which are attached one to either side of said power tong and are attached to respective ends of said arms to either side of the pivotal connection thereof.

For a better understanding of the present invention reference will now be made, by way of example, to the accompanying drawings, in which:-

Fig. 1 is a plan view of one embodiment of a positioning apparatus in accordance with the present invention;

Fig. 2 a side elevation of the positioning apparatus shown in Figure 1;

Fig. 3 a perspective view of the positioning apparatus shown in Figures 1 and 2 in use in a drilling tower;

Fig. 4 is a plan view of a second embodiment of a positioning apparatus in accordance with the present invention; and

Fig. 5 is a plan view of a third embodiment of a positioning apparatus in accordance with the present invention.

Referring to Figures 1 to 3 of the drawings there is shown a positioning apparatus which is generally identified by reference numeral 101.

The positioning apparatus 101 comprises two arms 102, 103 of variable length which are pivotally mounted on a beam 104 attached to a drilling tower 105.

The arms 102, 103 and the beam 104 together form a support triangle lying in a substantially horizontal plane.

The arms 102, 103 are pivotally interconnected at hinge 106 by means of end plates 107 and 108.

A cable 109 (Fig.3) is secured between a support member high in the drilling tower 105 and the hinge 106.

A power tong 110 is suspended from the support triangle by two rods 111, 112 which extend from opposite sides of the power tong 110 to the end plates 111 and 112.

Each of the arms 102 and 103 forms part of a mechanism 113 which is described in detail in EP-A-0 593 803 which is fully incorporated herein for all purposes. In particular the mechanism 113 comprises two chains 114 and 115. Each link of chain 114 is provided with a blocking member 116.

When a hydraulic motor 117 is rotated anti-clockwise as viewed in Figure 2 the links of the chain co-operate with the blocking members 116 to form arm 102 which is relatively rigid.

A connecting rod 118 connects the mechanism 113 to a similar mechanism 119 so that when the hydraulic motor 117 is rotated both arms 102 and 103 extend and retract in unison.

When it is desired to make-up or break-out a joint hydraulic motor 117 is actuated so that the arms 102 and 103 extend and the power tong 110 is moved to an operative position as shown in full lines in Figure 3. When the operation is complete the hydraulic motor 117 is reversed and the arms 102 and 103 contract to move the power tong 110 to an inoperative position shown in chain lines in Figure 3.

Each arm 102, 103 is pivotally mounted on the beam 104 by hinges 120, 121 respectively which pivot inwardly and outwardly as the arms 102, 103 are retracted and extended respectively.

The positioning apparatus 101 is operated from a remote control panel 122.

* * *

The positioning apparatus 101 shown in Figure 4 is generally similar to that shown in Figure 1 except that the arms 202 and 203 comprise double acting piston and cylinder assemblies which may be hydraulically or pneumatically operable, the former being recommended for precise control as hydraulic fluid is substantially incompressible. If desired, the arms 202, 203 could comprise single acting piston and cylinder assemblies acting against a return spring.

* * *

In the positioning apparatus 301 shown in Figure 5 the arms 302, 303 comprise racks which can be extended and retracted by rotation of pinions 323 and 324 by hydraulic motor 317.

* * *

It will be noted that in all the embodiments described the hinges 106, 206, 306, 120, 220, 320, 121, 221 and 321 all pivot about a generally vertical axis. In addition, it may be desirable to mount the ends of the arms remote from the hinges 106, 206, 306 for pivotal movement about a generally horizontal axis to accommodate the small vertical movement of hinges 106, 206, 306 as the arms are extended and retracted caused by the fixed length of the cable 109. This could conceivably be achieved by modifying the hinges or, alternatively, mounting the beam 104 for pivotal movement about a generally horizontal axis on the drilling tower 105.

* * *

Claims

1. A positioning apparatus (101; 201; 301) for moving a power tong (110) between an operative and an inoperative position in a drilling tower (105), which positioning apparatus (101; 201; 301) comprises a first arm (102; 202; 302) and a second arm (103; 203; 303), one end of said first arm (102; 202; 302) being pivotally mounted to one end of said second arm (103; 203; 303) and the other end of both said first arm (102; 202; 302) and said second arm (103; 203; 303) being pivotally mountable on said drilling tower (105) with said first arm and said second arm (102, 103; 202, 203; 302, 303) converging towards one another, and means (117; 217; 317) for extending and retracting said first arm (102; 202; 302) and said second arm (103; 203; 303).

2. A positioning apparatus as claimed in Claim 1, including a beam (104; 204; 304), wherein said other end of both said first arm (102; 202; 302) and said second arm (103; 203; 303) are pivotally mounted on said beam (104; 204; 304).

3. A positioning apparatus as claimed in Claim 1 or 2, including means (117; 217; 317) for extending and retracting said first arm (102; 202; 302) and said second arm (103; 203; 303) in unison.

4. A positioning apparatus as claimed in Claim 1, 2 or 3, wherein at least one of said first and second arms (102, 103) is formed by the interconnection of two chains (114, 115) the links of one of which chains (114) are provided with blocking members (116) which can co-operate with the links of the other chain (115) to form said arm (102, 103).

5. A positioning apparatus as claimed in Claim 1, 2, 3 or 4, wherein at least one of said first and second arms (202, 203) is formed by a piston and cylinder.

6. A positioning apparatus as claimed in Claim 5,

wherein said piston and cylinder is double acting.

7. A positioning apparatus as claimed in any preceding Claim, wherein at least one of said first and second arms (302, 303) comprises a rack which can be moved by rotation of a pinion (323, 324) or a worm drive engaged therewith.

8. A positioning apparatus as claimed in any preceding Claim, including a cable (109) for supporting said first arm (102) and said second arm (103) in a generally horizontal plane.

9. A drilling tower (105) provided with a positioning apparatus (101) as claimed in any preceding Claim.

10. A drilling tower (105) as claimed in Claim 9, wherein said first arm (102) and said second arm (103) are supported in a generally horizontal plane.

11. A drilling tower as claimed in Claim 9 or 10, wherein said one ends of said first arm (102) and said second arm (103) are pivotally mounted together about a generally vertical axis and said other ends of said first arm (102) and said second arm (103) are pivotally mounted about a generally vertical axis.

12. A drilling tower as claimed in Claim 9, 10 or 11, wherein said other ends of said first arm (102) and said arm (103) are pivotally mounted for movement about a generally horizontal axis.

13. A drilling tower as claimed in Claim 9, 10, 11 or 12 including a power tong (110) supported by said positioning apparatus (101).

14. A drilling tower as claimed in Claim 13, wherein said power tong (110) is supported via two support members (111, 112) which are attached one to either side of said power tong (110) and are attached to respective ends of said arms (102, 103) to either side of the pivotal connection (106) thereof.

* * *

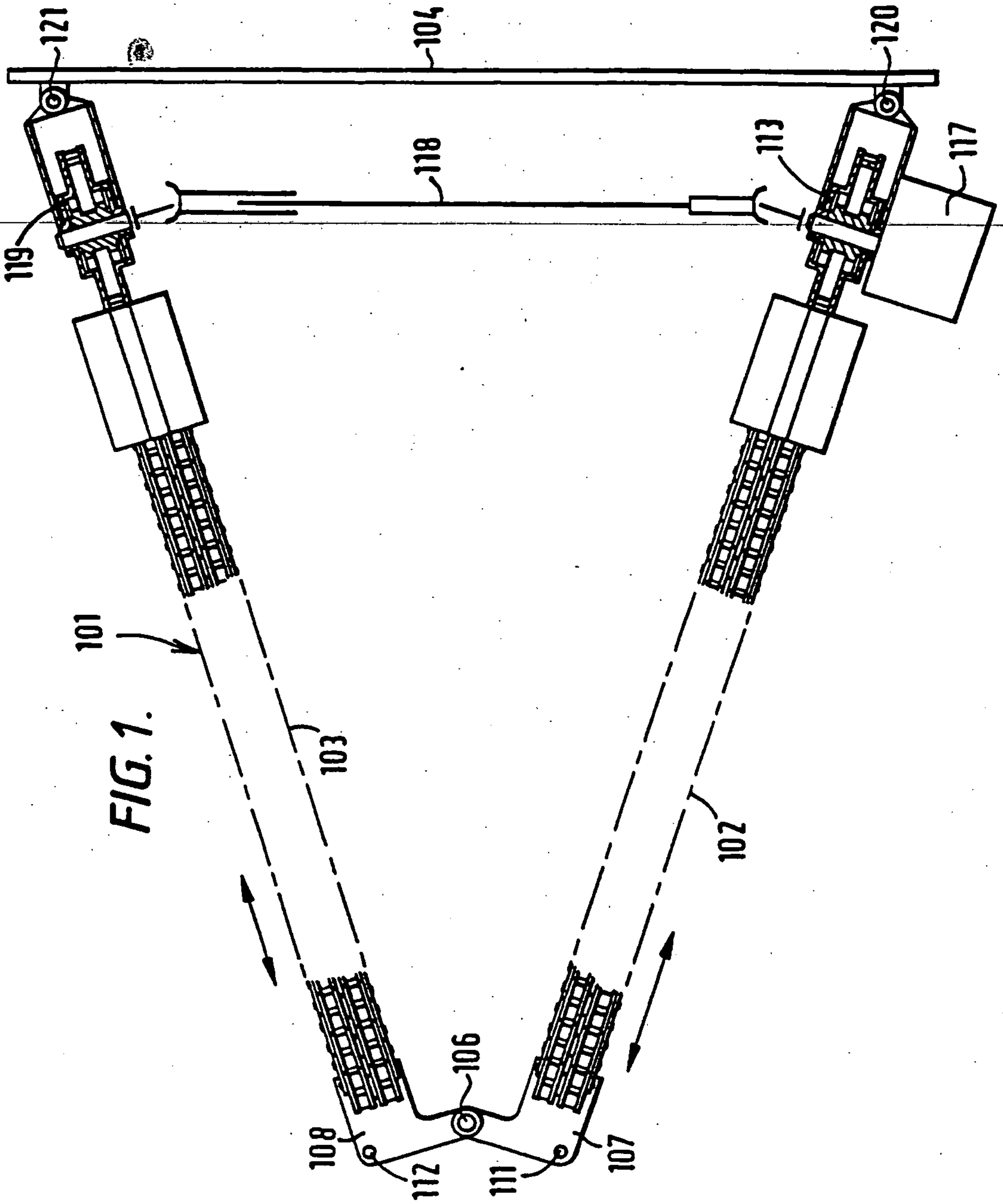

FIG. 1.

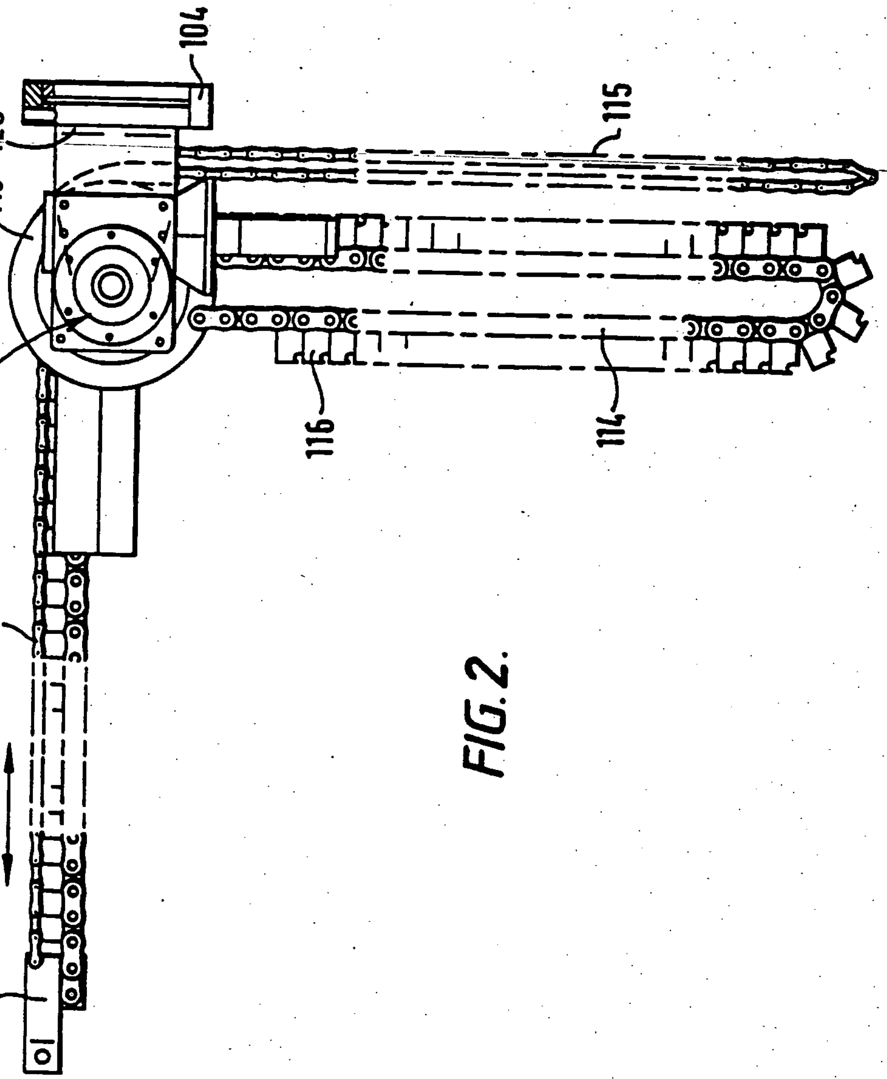

FIG. 2.

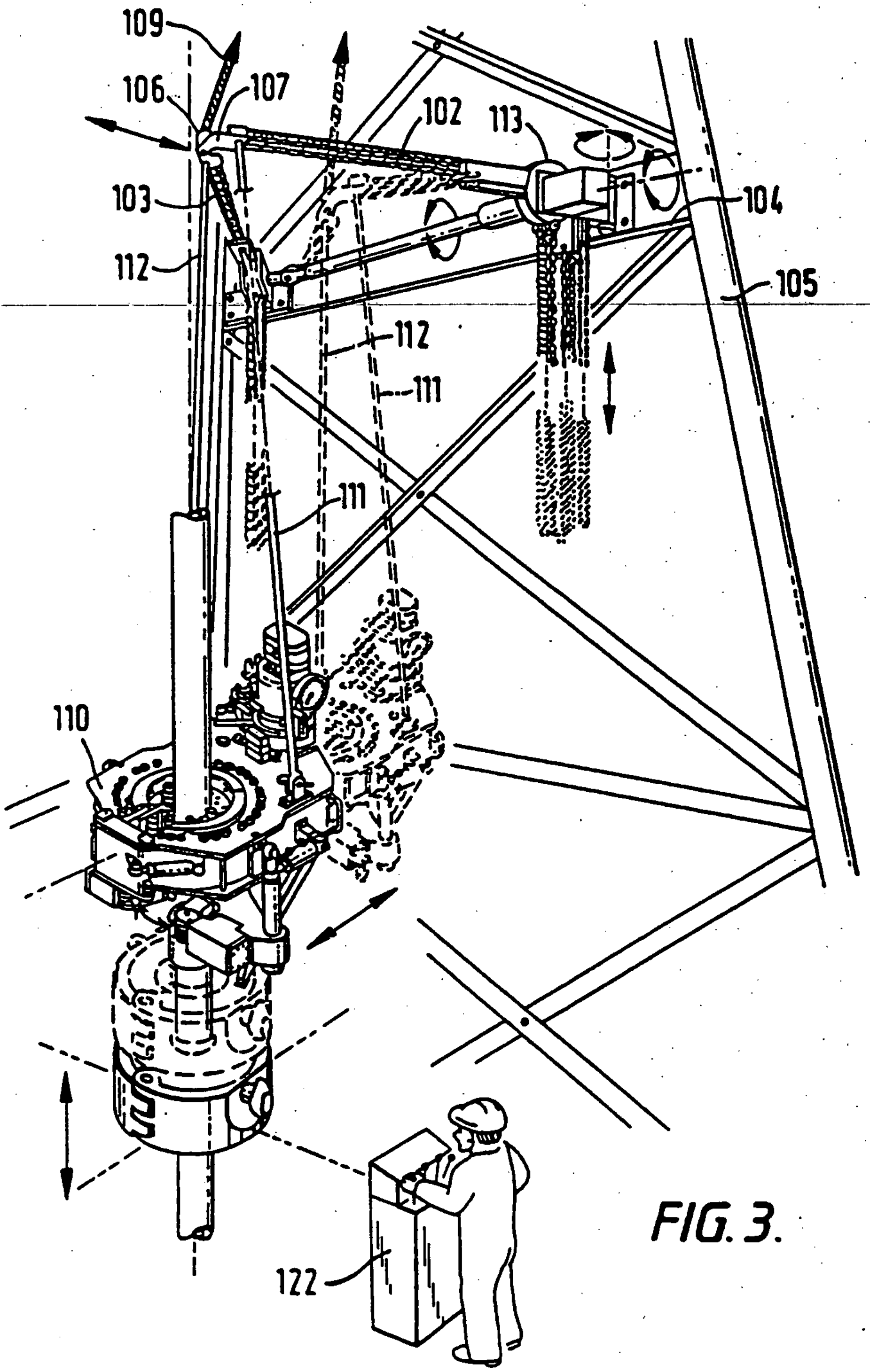

FIG. 3.

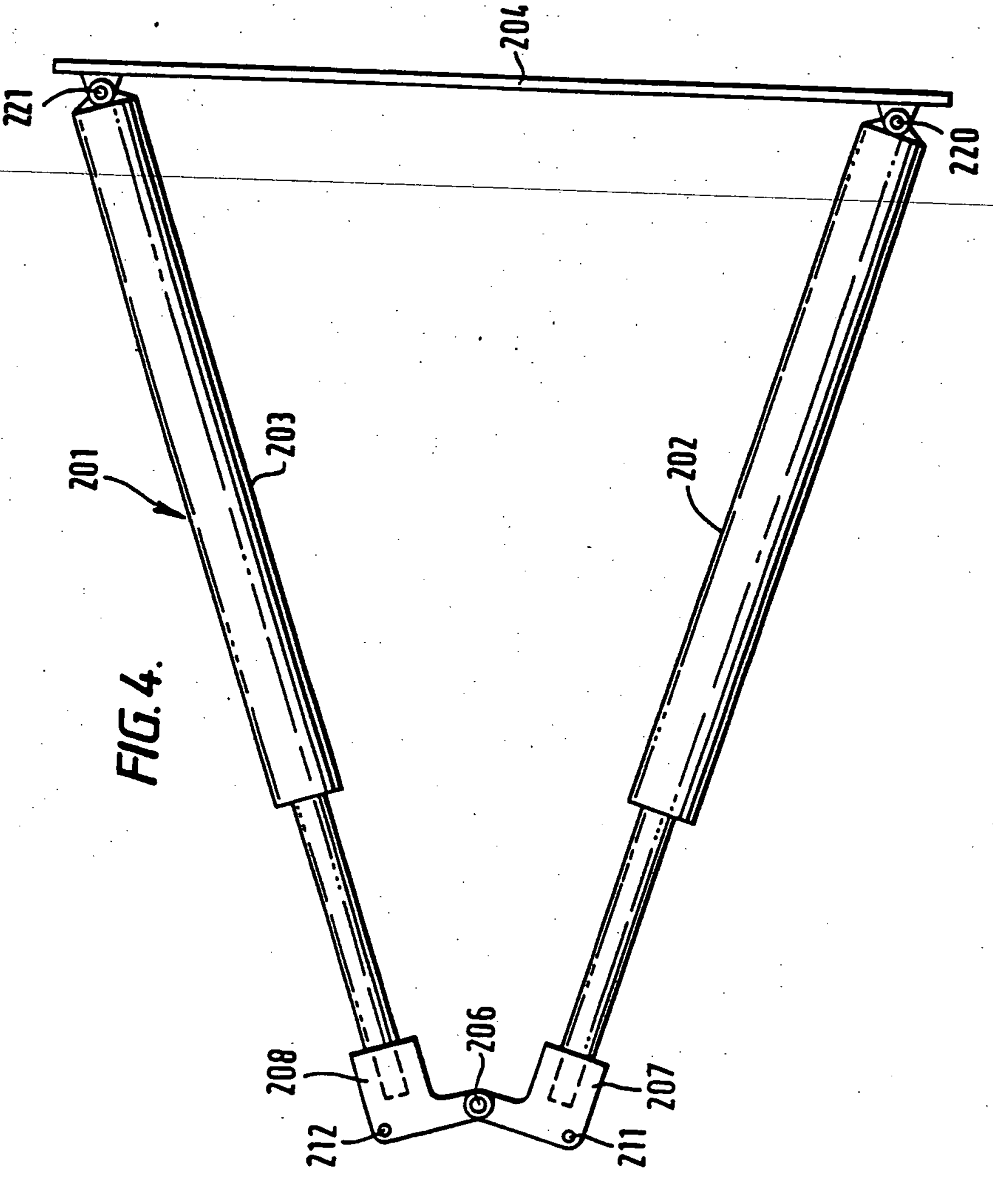

FIG. 4.

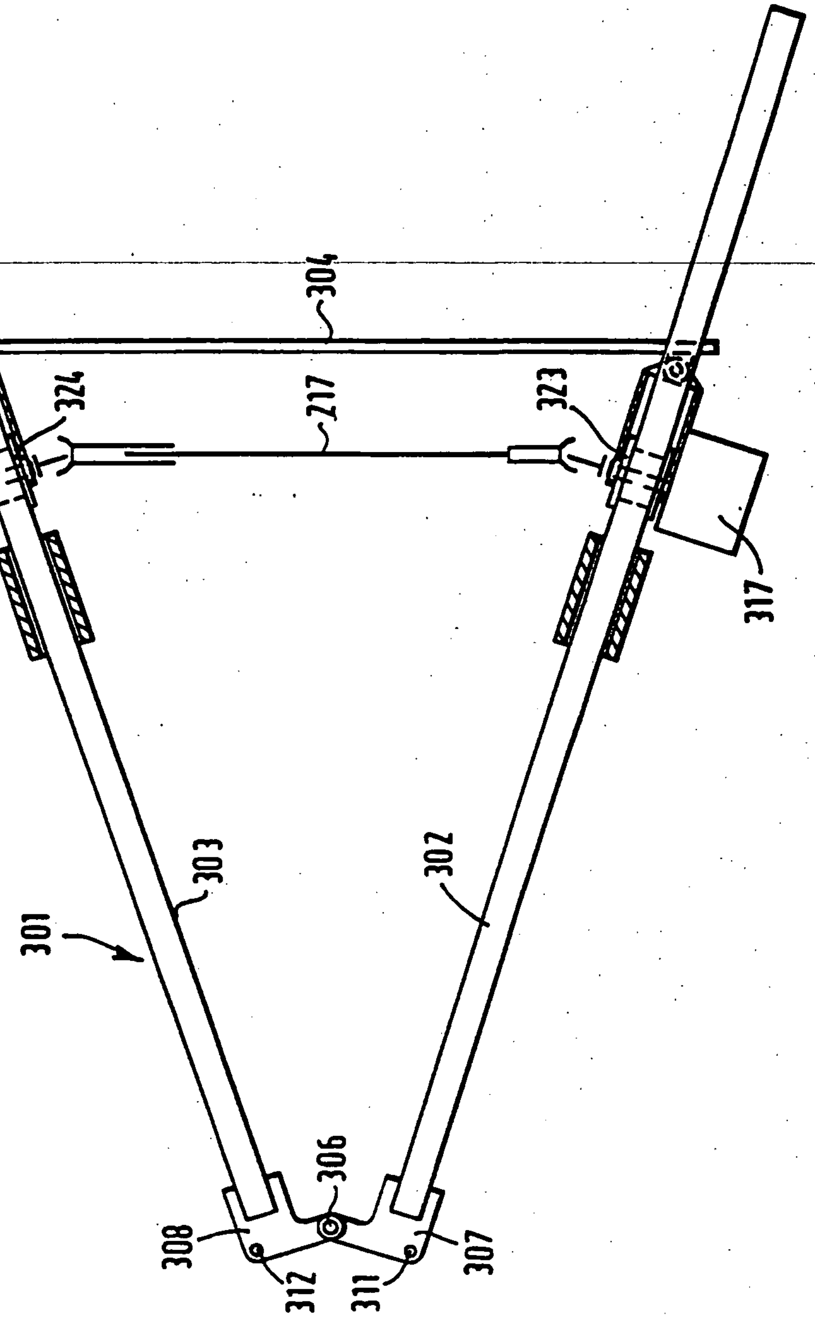

FIG. 5.

INTERNATIONAL SEARCH REPORT

Intern al Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 E21B19/14 E21B19/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 E21B B66F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,A	EP,A,0 593 803 (WEATHERFORD) 27 April 1994 cited in the application see the whole document ---	1,3,4, 8-11
A	US,A,4 274 777 (SCAGGS) 23 June 1981 see figures ---	1-6,8-14
A	US,A,3 799 009 (GUIER) 26 March 1974 see column 2, line 56 - column 3, line 8; figure 1 ---	1,9,13, 14
A	US,A,2 550 045 (J.P.DE HETRE) 24 April 1951 see figure 1 --- -/--	13,14

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Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,2 509 853 (N.K.WILSON) 30 May 1950 see figure 1 ---	1,9,13, 14
A	US,A,3 885 679 (J.J.SWOBODA) 27 May 1975 see figures -----	1

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Information on patent family members

International Application No

PCT/GB 94/02192

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